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### (54) Catheter with internal stiffening ridges

Katheter mit internen Versteifungsgegenständen

Cathéter avec nervures de rigidité internes

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## Description

[0001] The invention relates to a catheter comprising a tube-like basic body which is formed by a first tube-like element with a lumen which is bounded by a lumen wall and at least a second tube-like element which has been received in the lumen and comprises an outer wall, wherein of the outer wall and the lumen wall at least one has been provided with a number of ridges substantially extending in the longitudinal direction of the basic body.

[0002] Such a catheter is known from DE-A-2 820 239. The ridges reinforce in the first place the tube-like element on which they have been arranged, so that it does not buckle so easily. In addition, when bending the catheter the ridges may rest against the other tube-like element, which furthermore reduces the chance of buckling of the tube-like element onto which the ridges have been arranged. Thirdly, also the tube-like element which itself has not been provided with ridges, but is positioned against the ridges of the other tube-like element, becomes less prone to buckling due to the support provided in this manner. The basic body of the catheter according to the invention has consequently a very considerable buckling resistance.

[0003] According to the invention the measure as set out in the characterizing portion of claim 1 is employed, leading to a simple construction of the basic body. The second tube-like element may be pushed inside the first tube-like element and does not need to be fixed inside it. The favourable mutual influence of the buckling behaviour of the separate tube-like elements is also achieved in this case, as, because of the flattening deformation of the tube-like elements, a good contact is achieved between the ridges and the opposite wall on bending.

[0004] An advantageous further development has been characterised in claim 3. The top-surface supports the opposite wall evenly over its entire surface area, without concentrations of stress occurring which expedite buckling.

[0005] A high buckling resistance is achieved with the measures as set out in claim 4.

[0006] A suitable embodiment, which is also suitable for small to very small catheter-diameters, has additionally been characterised in claim 5.

[0007] In order to prevent a preferred bending direction of the basic body, the measure as set out in claim 6 is preferably employed.

[0008] The invention will be explained in greater detail in the following description with reference to the attached drawings.

[0009] Figure 1 shows a perspective view of a balloon catheter according to the invention.

[0010] Figure 2 shows a cross-section along the line II-II of figure 1.

[0011] A balloon catheter 1 illustrated in figure 1 comprises a tube-like basic body 2 at a distal end of which a balloon member 3 has been arranged. The proximal

end of the basic body 2 has been connected to connecting members 14, 15, the functions of which will be explained in greater detail below.

[0012] As can be seen in figure 2, the basic body 2 has been formed by a first tube-like element 5 with a lumen 12 which is bounded by a lumen wall 7. A second tube-like element 6 has been received inside the lumen 12, which itself comprises a lumen 11.

[0013] With this example of an embodiment the outer wall 8 of the second tube-like element 6 has been provided with ridges 9 which extend in the longitudinal direction of the basic body 2. The ridges 9 reinforce the second tube-like element 6 to such an extent that it tends to buckle less easily.

[0014] On bending the basic body 2 rather sharply, the lumen wall 7 will be positioned against the top-surfaces 10 of the ridges 9 due to a flattening of the cross-section of the first tube-like element 5. On the one hand the second tube-like element 6 is supported as a result, so that it can be bent more sharply before it buckles. On the other hand also the first tube-like element 5 is supported internally by the ridges 9, so that also this first tube-like element 5 buckles less quickly. The result of these effects is that the basic body 2 of the catheter 1 displays a significant resistance to buckling.

[0015] As can be seen in figure 2, the top-surfaces 10 of the ridges 9 are substantially concentric with the tube-like element 6 and consequently also with the tube-like element 5, so that these top-surfaces 10 make contact with the lumen wall 7 in an even fashion. Consequently, on making contact no concentrations of stress will occur in the wall of the first tube-like element 5, which is favourable in order to prevent buckling.

[0016] The function of the central lumen 11 in the second tube-like element 6 of catheter 1 is to accommodate a guide wire 16.

[0017] As is known, first a guide wire is introduced into a patient after which a catheter such as the catheter 1 is passed over the guide wire 16 into the body of the patient, until the balloon member 3 has arrived in the target position. The second tube-like element 6 extends over the entire length of the catheter and the lumen 11 thereof is accessible via the connecting member 15 at the proximal end.

[0018] The remaining space of the lumen 12 of the first tube-like element 5 has been made accessible via a connecting member 14 of which a channel is connected to this lumen 12 via an opening in the wall of the first tube-like element 5. At the distal end a number of openings 13 have been arranged in the wall of the first tube-like element 5 at the site of the balloon member 3, so that the lumen 12 is connected with the inside of the balloon member 3 via these openings 13. By introducing fluid under pressure into the balloon member 3 via the connecting member 14, this balloon member 3 may be expanded in order to carry out for instance angioplasty.

[0019] Although in the embodiment illustrated the ridges 9 have been arranged on the outer wall of the

second, inner tube-like element 6, it is also possible to provide the first, outer tube-like element 5 on the inside, on the lumen wall 7, with ridges. These ridges will reinforce in that case the first tube-like element, and due to the cooperation with the second tube-like element as described above, the resistance to buckling of the entire basic body 2 is furthermore increased.

[0020] In a suitable manner the number of ridges 9 is three, and the ridges have been arranged evenly distributed around the circumference. Other quantities of ridges are possible as well however.

[0021] In this way many variations of the inventive idea are possible. All these variations are considered to fall within the scope of the attached claims.

### Claims

1. Catheter 1 comprising a tube-like basic body 2 which is formed by a first tube-like element 5 with a lumen 12 which is bounded by a lumen wall 7 and at least a second tube-like element 6 which has been received in the lumen 12 and comprises an outer wall 8, wherein of the outer wall 8 and the lumen wall at least one has been provided with a number of ridges 9 substantially extending in the longitudinal direction of the basic body 2, characterized in that the second tube-like element 6 has been received in the lumen 12 of the first tube-like element 5 in a loose manner.
2. Catheter as claimed in claim 1, wherein a first connecting member 15 is coupled to the proximal end of the catheter 1 and has a channel which communicates with a lumen 11 of the second tube-like element 6, and a second connecting member 14 is coupled to the proximal end of the catheter 1 and has a channel which communicates with a lumen 12 defined between the inside wall of the first tube-like element 5 and the outside wall of the second tube-like element 6.
3. Catheter as claimed in claim 1, wherein the ridges 9 have a top-surface which is substantially concentric with the tube-like element 6 carrying the ridges.
4. Catheter as claimed in claim 1, wherein the number of ridges is odd and the ridges 9 have been arranged evenly distributed around the circumference.
5. Catheter as claimed in claim 4, wherein the number of ridges 9 is three.
6. Catheter as claimed in claim 1, wherein the ridges extend in a helical pattern.
7. Catheter as claimed in one of the preceding claims,

comprising a balloon member 3 arranged at the distal end of the tube-like basic body 2, a number of openings 13 having been arranged in the wall of the first tube-like element 5 at the side of the balloon member 3, so that the lumen 12 is connected with the inside of the balloon member 3 via these openings 13.

### 10 Patentansprüche

1. Katheter 1 mit einem röhrenförmigen Grundkörper 2, der durch ein erstes röhrenförmiges Element 5 mit einem Lumen 12, welches von einer Lumenwand 7 begrenzt ist, und mindestens ein zweites röhrenförmiges Element 6, welches im Lumen 12 aufgenommen worden ist und eine Außenwand 8 umfasst, gebildet ist, wobei von der Außenwand 8 und der Lumenwand mindestens eine mit einer Anzahl von Rippen 9 versehen worden ist, die sich im Wesentlichen in der Längsrichtung des Grundkörpers 2 erstrecken, dadurch gekennzeichnet, dass das röhrenförmige Element 6 auf eine lockere Weise im Lumen 12 des ersten röhrenförmigen Elements 5 aufgenommen worden ist.
2. Katheter wie im Anspruch 1 beansprucht, wobei ein erstes Verbindungselement 15 mit dem proximalen Ende des Katheters 1 gekoppelt ist und einen Kanal aufweist, der mit dem Lumen 11 des zweiten röhrenförmigen Elements 6 in Verbindung steht, und ein zweites Verbindungselement 14 mit dem proximalen Ende des Katheters 1 gekoppelt ist und einen Kanal aufweist, der mit einem Lumen 12, welches zwischen der Innenwand des ersten röhrenförmigen Elements 5 und der Außenwand des zweiten röhrenförmigen Elements 6 begrenzt ist, in Verbindung steht.
3. Katheter wie im Anspruch 1 beansprucht, wobei die Rippen 9 eine obere Oberfläche aufweisen, die im Wesentlichen konzentrisch ist mit dem die Rippen tragenden röhrenförmigen Element 6.
4. Katheter wie im Anspruch 1 beansprucht, wobei die Anzahl der Rippen ungeradzahlig ist und die Rippen 9 gleichmäßig verteilt um den Umfang herum angeordnet worden sind.
5. Katheter wie im Anspruch 4 beansprucht, wobei die Anzahl der Rippen 9 drei beträgt.
6. Katheter wie im Anspruch 1 beansprucht, wobei die Rippen sich in einem helikalen Muster erstrecken.
7. Katheter wie in einem der vorangehenden Ansprüche beansprucht, mit einem Ballonelement 3, das beim distalen Ende des röhrenförmigen Grundkör-

pers angeordnet ist, einer Anzahl von Öffnungen 13, die in der Wand des ersten röhrenförmigen Elements 5 an der Stelle des Ballonelements 3 angeordnet wurden, so dass das Lumen 12 über diese Öffnungen 13 mit dem Inneren des Ballonelements verbunden ist.

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la paroi du premier élément semblable à un tube 5 du côté de l'élément formant ballon 3, de sorte que la lumière 12 soit connectée avec l'intérieur de l'élément formant ballon 3 via ces ouvertures 13.

### Revendications

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1. Cathéter 1 comprenant un corps de base semblable à un tube 2 qui est formé par un premier élément semblable à un tube 5 avec une lumière 12 qui est limitée par une paroi de lumière 7 et au moins un second élément semblable à un tube 6 qui est reçu dans la lumière 12 et qui comprend une paroi extérieure 8, dans lequel un élément au moins parmi la paroi extérieure 8 et la paroi de lumière est muni d'un certain nombre de stries 9 s'étendant sensiblement dans la direction longitudinale du corps de base 2, **caractérisé en ce que** le second élément semblable à un tube 6 est reçu dans la lumière 12 du premier élément semblable à un tube 5 de manière lâche.

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2. Cathéter selon la revendication 1, dans lequel un premier élément de connexion 15 est couplé à l'extrémité proximale du cathéter 1 et possède un canal qui communique avec une lumière 11 du second élément semblable à un tube 6, et dans lequel un second élément de connexion 14 est couplé à l'extrémité proximale du cathéter 1 et possède un canal qui communique avec une lumière 12 définie entre la paroi intérieure du premier élément semblable à un tube 5 et la paroi extérieure du second élément semblable à un tube 6.

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3. Cathéter selon la revendication 1, dans lequel les stries 9 possèdent une surface supérieure qui est sensiblement concentrique avec l'élément semblable à un tube 6 portant les stries.

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4. Cathéter selon la revendication 1, dans lequel le nombre de stries est impair et les stries 9 sont réparties de manière régulière autour de la circonference.

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5. Cathéter selon la revendication 4, dans lequel le nombre de stries 9 est de trois.

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6. Cathéter selon la revendication 1, dans lequel les stries s'étendent selon un schéma hélicoïdal.

7. Cathéter selon l'une quelconque des revendications précédentes, comprenant un élément formant ballon 3 disposé au niveau de l'extrémité distale du corps de base semblable à un tube 2, un certain nombre d'ouvertures 13 ayant été disposées dans

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